

# Water bodies of former peat pits as the most important nesting sites for some species of *Laridae* in the center of European Russia

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**Abstract.** In this paper, we analyze the role of artificial water bodies in the former peat pits as habitats for gulls and terns based on long-term monitoring data in the Nizhny Novgorod oblast (area 76.624 km<sup>2</sup>), located in the center of European Russia. 3 regional censuses of *Laridae* were carried out in 1985-87, 1997, and 2006-2007. The monitoring of the largest colony of gulls in the region at the IBA Sitnikovski RU-185 was carried out in 1982, 1987, 1994, 1997, 2002, 2006, 2011 and 2023. It is shown that very large colonies of many species of *Laridae*, representing complexes of closely located colonies, have formed on the peat pits in the Nizhny Novgorod oblast. Peat pits are the most important nesting sites for *Larus ridibundus*, *L. canus* and *L. argentatus* in the central part of European Russia. In the Nizhny Novgorod oblast, more than 50% of the regional population of these species nests in these habitats. Monitoring only the Sitnikovski colony allows us to judge the trends in the numbers of most species of *Laridae* in the Nizhny Novgorod oblast at large. Based on extrapolation of population data at Sitniki peat pits we can calculate the approximate numbers of regional breeding populations of *Larus minutus*, *L. ridibundus*, *L. canus* and *L. argentatus*.

## 1 Introduction

That is not random at all that birds of *Laridae* became the first model for developing national and regional inventories of wildlife in 1986-1987 [1-4]. This group is of great ecological and practical importance [1, 5-6]. The importance of gulls in nature is determined by the high number and biomass of many species, as well as colonization and behavioral characteristics. Gulls are often very important in the formation of ornithocomplexes as key-species. In the nesting places of colonies of these birds, there is a significantly higher density of other waterfowl and near-aquatic species, many of which are

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important protected or game species. The study and monitoring of gulls allows us to research the patterns of adaptations to the human impact on environment [7-9]. Different species of gulls and terns demonstrate a wide range of reactions to the effects of anthropogenic factors – from obvious tendencies to synanthropization to obvious anthropophobia. Due to the wide distribution, high numbers and seasonal migrations, gulls are of great epidemiological importance as carriers of avian influenza, helminthiasis and other diseases [10-15]. At the same time, the tendency to colonial nesting leads to the concentration of a large number of birds in a few small territories. This makes this group of birds very vulnerable and in need of special protection measures [16-17].

One of the most important impacts on the ornithocomplexes developing in the XX-th century was the systems of water bodies forming in the former peat pits. These new natural and artificial habitats turned out to be extremely attractive for waterfowl and near-water birds, primarily for *Laridae* [18-22]. In this paper, we analyze the role of water bodies of former peat pits as habitats for *Laridae* based on long-term monitoring data. The research was conducted in the Nizhny Novgorod oblast (area of 76,624 km<sup>2</sup>), located in the center of European Russia.

## 2 Materials and methods

Total of 3 regional censuses of gulls and terns were conducted in the Nizhny Novgorod oblast. The terms, methods of research and the volume of the data collected are presented in Table 1.

**Table 1.** Data and extent of the census carried out in the oblast.

Data of census	Method of census	Extent of the census carried out	Number of colonies		
			discovered	surveyed	listed in the database
1985–1987	Questioning the locals	In 21 administrative districts	58	-	226*
	Field surveys	1125 hours of field surveys, 80 km of pedestrian routes		32	
1997	Questionnaire	1.731 questionnaires with identification booklets were sent out, 5% of them were returned, including 2.8% with positive responses	48	-	243
	Field surveys	21 surveys in 31 administrative districts with 2089 km of water and 2500 km of vehicle routes	124	143	
2006-2007	Field surveys	2611.56 km of vehicle routes in 24 administrative districts	22	82	289**
		583.78 km of water routes along 5 rivers	2	55	

\*170 colonies discovered next years are added to estimate the number retrospectively; \*\* including 43 extinct colonies

The records of *Laridae* in particular colonies were carried out according to the following generally accepted methods:

- Registration of all the nests.
- The method of study plot: identification of sites with different densities of nesting, registration of all the nests at the study plots and subsequent extrapolation to the entire area occupied by the colony.

- The transect method: records of nests or adult birds on the study plots located along the transect.
- Considering the number of adults in the colony. Since about half of the adults are present in the colony at the end of the chick feeding period (the third decade of June), the number of breeding pairs was assumed to be equal to the number of adults.
- Basing on observations of foraging movements of birds.

In this paper *Larus argentatus* is considered as a combined species: a complex of all large white-headed gulls breeding in the Nizhny Novgorod oblast (*Larus argentatus*, *L. cachinnans*, *L. heuglini*). In the center of European Russia, all these forms nest in the same colonies, forming mixed pairs [17].

The number of colonies of gulls and terns of different species which the population has been determined is shown in Table 2. The sum of the figures in the columns does not correspond to the total number of identified colonies, because many of them are formed by several species.

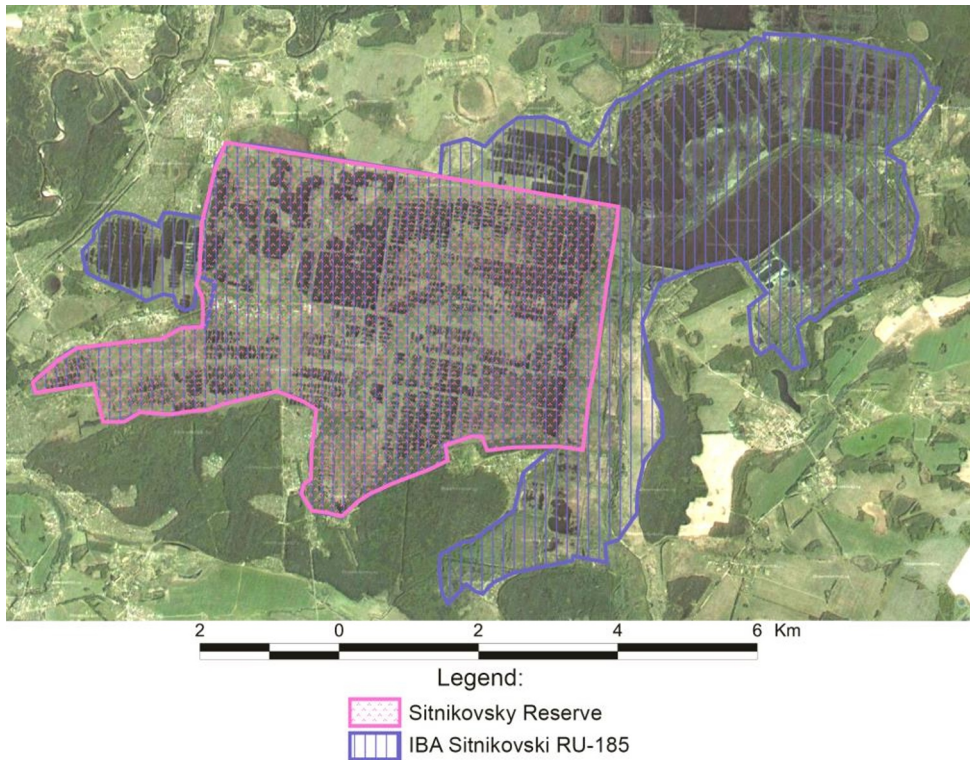
**Table 2.** The number of colonies of *Laridae*, which the population has been determined in different dates.

Species	Number of colonies in the N.Novgorod oblast in:		
	1987	1997	2007
<i>Larus minutus</i>	16	23	24
<i>Larus ridibundus</i>	90	92	67
<i>Larus canus</i>	61	79	87
<i>Larus argentatus</i>	5	30	26
<i>Sterna hirundo</i>	118	134	176
<i>Sterna (Sternula) albifrons</i>	52	63	76
<i>Chlidonias niger</i>	43	54	73
<i>Chlidonias leucopterus</i>	26	30	50

The largest colony of gulls and terns in the Nizhny Novgorod oblast was formed on the Sitniki peat pits, located 20 km northeast of Nizhny Novgorod. It was first surveyed in 1982. In 1987, the Sitnikovsky Ornithological Reserve was established here. This territory was assigned to the IBA in 2000 [23]. The ratio of the borders of IBA Sitnikovski RU-185 and the reserve is shown in Figure 1. Monitoring of the condition of the gull colonies on the Sitniki peat pits was carried out not only within the regional censuses, but also in 1994, 2002, 2011, 2023 (Table 3).

**Table 3.** Population trend of *Laridae* in the Sitniki peat pits.

Species	Number of breeding pairs in:							
	1982	1987	1994	1997	2002	2006	2011	2023
<i>Larus minutus</i>	0	0	0	10	0	36	30	15
<i>Larus ridibundus</i>	20700	18800	16100	5206	3000	2131	2000	1364
<i>Larus argentatus</i>	3	10	97	113	170	179	290	579
<i>Larus canus</i>	7200	8100	9400	10128	8200	6103	8000	8933
<i>Chlidonias niger</i>	0	0	0	0	0	22	0	33
<i>Chlidonias leucopterus</i>	0	0	0	0	0	6	0	0
<i>Sterna hirundo</i>	450	380	420	341	175	433	350	138



**Fig. 1.** The ratio of the Sitnikovsky Reserve and IBA Sitnikovski RU-185 borders.

### 3 Results

Based on the results of regional surveys, the number of all species of *Laridae* in the oblast was determined (Table 4).

**Table 4.** Number of *Laridae* in the N. Novgorod oblast according to the regional censuses.

Species	Number in the N. Novgorod oblast (pairs) in:		
	1987	1997	2007
<i>Larus minutus</i>	1840	516	1068
<i>Larus ridibundus</i>	68325	29000	14390
<i>Larus argentatus</i>	11	410	689
<i>Larus canus</i>	16435	21545	15845
<i>Chlidonias niger</i>	1725	1525	2666
<i>Chlidonias leucopterus</i>	1045	425	2758
<i>Sterna hirundo</i>	4215	4150	5382
<i>Sterna (Sternula) albifrons</i>	1210	1288	1637

The percentage of colonies of different species of *Laridae* on former peat pits of the total number of colonies in the Nizhny Novgorod oblast was calculated (Table 5).

**Table 5.** Percentage of colonies of *Laridae* on the former peat pits of the total number of colonies in the Nizhny Novgorod oblast.

Вид	Share of colonies in IBA Sitnikovski RU-185 of the total number of colonies in the N.Novgorod oblast (%) in:		
	1987	1997	2007
<i>Larus minutus</i>	6.25	4.35	12.50
<i>Larus ridibundus</i>	37.78	28.26	32.84
<i>Larus canus</i>	49.18	34.18	29.89
<i>Larus argentatus</i>	60.00	33.33	38.46
<i>Sterna hirundo</i>	22.03	19.40	12.50
<i>Sterna (Sternula) albifrons</i>	0.00	0.00	0.00
<i>Chlidonias niger</i>	0.00	1.85	4.11
<i>Chlidonias leucopterus</i>	0.00	0.00	4.00

The percentage of the regional population of all species of *Laridae* inhabiting peat pits in general and the Sitniki peat pits in particular was also determined (Table 6).

**Table 6.** Percentage of the total number of *Laridae* species in the oblast breeding on peat pits in general and the Sitniki peat pits in particular.

Species	Share of birds of the total number in the oblast (%) breeding					
	on all the peat pits in:			on the Sitniki peat pits in:		
	1987	1997	2007	1987	1997	2007
<i>Larus minutus</i>	3.53	5.81	6.37	0.00	1.94	3.37
<i>Larus ridibundus</i>	61.68	70.73	57.83	27.52	17.95	14.81
<i>Larus canus</i>	90.00	87.93	78.08	50.00	27.56	25.98
<i>Larus argentatus</i>	94.13	93.36	90.53	49.29	47.01	38.52
<i>Sterna hirundo</i>	29.77	23.51	23.86	9.02	8.22	8.05
<i>Sterna (Sternula) albifrons</i>	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chlidonias niger</i>	0.00	2.62	0.94	0.00	0.00	0.83
<i>Chlidonias leucopterus</i>	0.00	0.00	2.94	0.00	0.00	0.22

## 4 Discussion

Following data presented in Table 4 *Larus minutus* reduced its number by almost 4 times between 1987 and 1997 as a result of the largest water body with the largest colony in the region crushing in the course of economic activity. *Larus ridibundus* during the entire period of research demonstrates a rapid decline in its numbers, the reasons for which are not clear and are not related to the conditions of nesting sites. *Larus argentatus* has been observed in the region since the early 1980s. The first 3 nests were found in 1982 on the Sitniki peat pits. During the research period, there has been a rapid increase in the number of the species. The population of *Larus canus* was rather high in 1987. In the middle of the XXth century, its nesting sites in the region were not known at all [24-25]. Judging by the occurrence of this species in Nizhny Novgorod, the population growth occurred during the 1970s and continued in the period from 1987 to 1997. In the next decade, the number of the species decreased to about the level of 1987.

The average results of regional surveys do not provide an adequate picture of the population trend of the *Chlidonias* species. Their numbers and locations of colonies varied significantly over the years, which make it difficult to identify their population trends. The

number of the *Sterna* species was relatively stable during the monitoring period with a slight upward trend.

Based on the data presented in the Table 5 and 6, it can be argued that in relation to peat pits, 3 groups of species within *Laridae* are clearly distinguished:

- The first one includes one species – *Sterna albifrons*, which nests only in areas of sand sediments along the shores and islands of large and medium-sized rivers. Peat pits are unsuitable for its nesting.
- The second group consists of species originally preferring mainly floodplain water bodies to nest (*Larus minutus*, *Chlidonias niger* and *C. leucopterus*). The importance of peat pits as their nesting sites is insignificant. These birds are not regularly found in the water bodies of the former peat pits, the share of their number nesting in this type of habitat is very small. However, even these species have a slow tendency to develop this type of habitat – in the period from 1987 to 2007, their occurrence and abundance on peat pits increased slightly, but this trend needs to be clarified based on the results of the future monitoring. It should be discovered whether this trend is related to the succession of pit habitats or to an increase in tolerance to new nesting sites.
- The third group unites *Larus ridibundus*, *L. canus* and *L. argentatus*, as well as *Sterna hirundo*, for which the role of peat pits as nesting sites is very significant. For gulls, peat pits (artificial habitats, often located a short distance from the cities being sources of forage resources) formed opportunities for significant population growth at the end of the XXth century. These artificial water bodies played a special role for *L. argentatus*. This species has invaded into the central part of European Russia thanks to peat pits, which turned out to be optimal nesting sites for it in the newly developed territory. The share of *L. argentatus* nesting on peat pits has been slowly decreasing over the 40-year period of research as a result of the species gradual colonizing other nesting sites.

In the Nizhny Novgorod oblast, the Sitniki peat pits, occupying a vast area of 3700 hectares, diverse in depth and size of reservoirs, located at a short distance from the Nizhny Novgorod city agglomeration, turned out to be the most convenient for the development of the largest colony. In the early 1980s, the Sitniki colony of *Laridae* was the largest in continental Europe [23]. The Table 6 shows the share (up to 50%) of the number of some gull species nesting in the Sitniki peat pits per the total species number in the region being very large.

The population trend of gulls in the Sitniki colony, which has been well surveyed over 40 years of monitoring (Table 3), generally corresponds to the regional one. Therefore, based on the calculations carried out only on the Sitniki peat pits, it is possible to judge the population trends of gulls in the region. For some species (*Larus ridibundus*, *L. canus* and *L. argentatus*), it is even possible to calculate the regional number based only on the Sitniki sample (Table 7).

Thus, based on extrapolation of monitoring data of the Sitniki colony of *Laridae*, it is possible to estimate the regional numbers of *Larus* species.

## 5 Conclusion

As a result of our research, peat pits has been shown being the most important nesting sites for many gulls (*Larus ridibundus*, *L. canus* and *L. argentatus*) in the central part of European Russia. In the Nizhny Novgorod oblast, more than 50% of the regional population of these species prefers these habitats. The importance of peat pits as nesting sites for common terns is also great (on average about 25% of the regional population). The little gull, black and white-winged terns use peat pits as nesting sites, but the significance of these habitats for these species is small. Only the little tern, preferring the areas of sands

slightly overgrown with grass on the shores and islands of reservoirs, does not nest on peat pits.

**Table 7.** Calculated numbers of *Laridae* species in the Nizhny Novgorod oblast according to the data of surveys carried out on the Sitniki peat pits

Species	Number in the Sitnikovski colony in 2023, pairs	Share of the total number in the N.Novgorod oblast, %	Calculated number in the N.Novgorod oblast in 2023, pairs	Comments
<i>Larus minutus</i>	15	2.65	565	some underestimated
<i>Larus ridibundus</i>	1364	16.38	8327	close to actual
<i>Larus canus</i>	8933	42.76	20890	close to actual
<i>Larus argentatus</i>	579	26.77	2163	close to actual
<i>Sterna hirundo</i>	138	8.13	1697	underestimated by about half
<i>Sterna (Sternula) albifrons</i>	0	0.00	?	calculation is impossible
<i>Chlidonias niger</i>	33	0.41	7998	significantly overestimated
<i>Chlidonias leucopterus</i>	0	0.11	?	calculation is impossible

Very large colonies inhabited by different species of *Laridae*, being the complexes of closely located smaller colonies, have formed on the peat pits of the Nizhny Novgorod oblast. The largest colony of *Laridae* in the region is located on the IBA Sitnikovski RU-185.

Monitoring only the Sitnikovski colony allows us to reveal the population trends of most species of *Laridae* in the Nizhny Novgorod region as a whole. For gulls, based on extrapolation of population data on the Sitniki peat pits, we can calculate the approximate number of regional breeding groups.

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